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ABSTRACT

This paper predicts that microelectronic circuitry will have an impact on education comparable to that of the industrial revolution or the invention of the printing press. Present conditions influencing educational technology and trends are considered in light of five considerations: (1) recent redefinitions of what educational technology is; (2) energy and economic crises; (3) acceleration of relative costs in education due to increased costs of traditional educational materials and decreasing costs of production and use of the silicon wafer; (4) demands for knowledgeable instructional developers to design software programs for use with electronic educational media; and (5) increasing demands for placement of educational media in business, industry, homes, and elsewhere outside schooling. It is concluded that despite inflation, potential for recession, and the energy shortage, the field of educational technology shows growth. Thirteen references are included. (Author/LMM)

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EDUCATIONAL TECHNOLOGY IN THE CRYSTAL BALL

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Abstract

Microelectronic circuitry are predicted as having an impact on education comparable to the industrial revolution or invention of the printing press. Trends are predicted in light of five considerations: recent redefinitions of what educational technology is; energy and economic crises; acceleration of relative costs in education due to increased costs of traditional educational materials and decreasing costs of production and use of the cilicon wafer; demands for knowledgeable instructional developers to design software programs for use with electronic educational media; and increasing demands for placement of educational media in business, industry, homes and elsewhere outside schooling.

EDUCATIONAL TECHNOLOGY IN THE CRYSTAL BALL*

It is usually presumptuous to predict future trends on the basis of, at best, vaguely characterized present conditions. The reader may be wise to approach this discussion of the future of educational technology as a quick peek into a crystal ball. It is expected that this article may provide some helpful descriptions of present conditions influencing educational technology. Following are five:

1. Widespread redefinitions of what educational technology is: It is now generally considered as not only media hardware (i.e., slide, film, video, overhead projectors, etc.) but, also, is defined as the appropriate use of such hardware in support of instruction. Distinctions between course development, evaluation, design and planning of media modules, learning systems, etc. have in recent years become somewhat blurred. For evidence of this, the reader is referred to almost any recent issue of the Journal of Instructional Development. Also, see Gustafsen's (1979) article, "Does Instructional Development Have a Future?"
2. The energy crisis and economic crunch, recession/inflation predicate budget cutbacks throughout various levels of American society; including, educational technology.
3. There is at present an accelerating impact on relative costs and varying methods of teaching and learning being brought about by increased availability of microelectronics within media technology (Audiovisual Instruction, 1979).

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4. In the field of education as a whole (not only in schools) there appears to be an increasing recognition of instructional development and its appropriate relation to media hardware as a perpetual obligation of educational professionals.
5. There is increasing placement of media within business, industry, homes, and elsewhere outside schooling. (Sink, 1979 and Patton, 1980).

Of course, the list (above) is not intended to be an exhaustive treatment of the problem of conceptualizing the present state of educational technology, much less its future! However, the possible future impact of each of these more or less salient considerations will be discussed below.

Discussion

Redefinitions of educational technology. Design, production, and management of learning products and strategies for the purpose of creating solutions to educational problems are usually what is meant by educational technology. This notion of what educational technology is about has changed since schools first began to use media hardware. (Burke, 1972)

Whereas, in the early decades of this century, the use of media was viewed as separate from instructional design, at present there seems to be increasing concern for the appropriateness of the uses of media and precisely how it supports instructional objectives and activities. The Journal of Instructional Development (1980, Vol. 3 3) in an issue devoted to evaluation includes articles on the future of educational technology in industry and evaluation for the selection of

instructional materials. This is evidence of increasing concern for appropriate use of media technology.

Now, educational technology is broadly conceived to include application of learning theories and behavioral science to the apparent instructional needs of the learners. This has included growing concern for the underlying structure of content to be learned and its possible relations to hardware as well as a focus on the problem of conceptualizing how people learn.

Detailed analyses of content structure have become a first step in educational technology...at least one step before plugging in the machine...a prerequisite to systematic instructional design for use with media. A large variety of techniques for analyzing content structure have made their way into the field. These include behaviorally-based, taxonomic approaches (Bloom, 1969 and Gronlund, 1970), approaches based on concept acquisition theory and cognitive psychology (Brunner, 1957 and Piaget, 1952), information processing systems (Scandura, 1969), intervention-orientation theory (Merrill, 1976) to name a few. (See Kemp, 1977 or Davis, 1974 for a more thorough treatment of some of these approaches).

What the educational technologist actually may be doing in the future could depend somewhat on how that person conceptualizes the problem of how people think. And, that might include any one of the above learning theories or others not yet developed.

Then, too, there appears to be a centering on communication, itself, and less on gadgets and electro-mechanical thing-ness. Behavioral, social, ecological and organizational questions have been given a larger place, with "technology" or media hardware constituting

the warp within which such varied strands of educational concern may or may not be woven. So, analysis of the design of instruction in the future ought reasonably to be expected to include not only operant psychology, but also concern for the utility, cost, relevance, and humaneness of the resulting instructional experience (i.e., some auto-tutorial programs were redundant and boring). This suggests there may be increasing expenditures of time, energy, and resources for formative and summative stages of evaluating, educational technology efforts and activities.

The energy crisis and the economic crunch. It could be argued that educational technology throughout American society will in the future be hampered by economic decline related to the energy crisis. Perhaps, it is undeniable that budget cutbacks in some sectors of society have already been caused by recession/inflation.

Moreover, production of media hardware depends heavily on the petroleum industry. While availability of media technology may not necessarily be prevented by the energy crunch, costs of media now being produced might reasonably be expected to continue to rise...even prohibitively.

Increased availability of microelectronics. It seems likely that microelectronics may overcome at least some of the possible adverse economic trends related to the energy crisis. Microelectronics are very cheap, small, complex electronic control devices constructed on a tiny wafer of silicon. They have been viewed by some educational technologists as potential change agents of society comparable with the industrial revolution. Unlike the industrial revolution, changes wrought by microelectronics may occur within decades, rather than centuries.

Advances in educational technology represented by microelectronics are likely to proceed regardless of the energy/economic situation, because these microcircuits are packed into a very small space and consume less energy in their production as well as their use than previously developed media packages. They can be manufactured in huge quantities with energy, materials, and cost expenditure compared with previous media hardware, that is almost infinitesimal. In the industrial revolution, machines replaced human muscle. Now the microelectronic wafer is now in the process of replacing human programming in various ways.

The microcircuit as a replacement for human programming is not greatly different from what has been available for two decades (e.g., computer control). What is now different is the decrease in size, power consumption and production costs ..and, hence, availability. This means large scale applications at economically feasible levels ought to become available within the field of educational technology, despite budget cutbacks.

In short, microelectronics appear to be a promise of cheaper, smaller devices for use within educational technology on a scale previously not practical. For example, some currently developed applications of these devices include: 1) assembly-line robots in the car industry; 2) bank deposit-accepting machines directly linked into a bank's computer; 3) Postal service of the U.S. Post Office; 4) driverless transport in the London Victoria Live Tube, etc.

Implications for use of microelectronics in this more widespread way are not yet entirely clear. What is clear is that because of their practicality their use is likely to increase. It seems possible

that some effects might include: 1) the need to prepare people for employment in technologically advanced occupations (e.g., in health centers, social service agencies, banks, industry, learning centers, etc.); 2) to prepare educational technologists for later training in design skills to conceive of products and learning systems so they can be made both effectively and economically (e.g., in industry).

As mentioned earlier, economic problems facing America in the next decades may affect educational technology more or less, depending on the extent to which technology with microelectronics is designed for both effectiveness and practicality. The history of media in this century is a history of such increasing effectiveness: e.g., cheaper, more efficient, and reliable hardware such as auto-tutorial, audio-visual, teletext terminals, videodisks, TV games, pocket calculators, affordable home/office video recorders and computers, etc.

Increasing development of microelectronics in media hardware has already begun to effect changes of various sorts. Some changes that may be most directly related to predicting the future of educational technology might include: 1) increasing accessibility of various kinds of educational systems outside school settings; 2) more widespread use of computers in assisting and managing learning and instruction; 3) modifications in existing systems within schools; e.g., cable television, hand-held calculators, auto-tutorial programs on modified television, etc. It may not be entirely presumptuous to suggest that effects of microelectronics on computer-related information systems could be as formidable as was development of the printing press on education.

Instructional development has become a key component of educational technology. This trend seems likely to continue to accelerate. Optimum exploitation of various technological advancements with microelectronics may depend on the availability of trained educational technologists and instructional developers. These people are needed to organize relevant information for use in media hardware, such as teletex and viewdata in homes, offices, public libraries, museums, post offices and similar locations outside traditional school settings. Even modified television receivers have been expanded to accommodate home learning programs. Who will design all these learning systems?

Moreover, it is conceivable that with the increased availability of home and office computers, training in software computer programming may eventually be a required course in secondary schools or available in adult education courses for businessmen with computers in their offices.

Potential for expansion of education outside of schools. This expansion is unprecedented in the history of the world and educational technology is a spearhead of this thrust. Darryl L. Sink (1979) reports the 1977-78 trends for media graduates showed increased placement in business and industry. Leading job functions were to administer media programs, but the number of instructional developers in educational technology doubled during that period.

Patton reported in a recent issue of the Journal of Instructional Development that "Educational technology has had a significant influence on the field of training in business and industry; the greatest impact has been upon the analysis phase of course development. Need, task, and target population analyses are used more and more to define course

content. Five improvements are needed if educational technology is to further its influence on business and industry: a) course development time must be shortened without adversely affecting course quality; b) subject matter experts must be used more effectively; c) educational technology techniques must be applied in the field of management development; d) the scope of educational technology must be expanded to include the maintenance of behavior; and e) greater attention must be given to the differences between the adult learners found in business and industry and learners in other age-group settings. Cooperation between trainers in the private sector and academicians will be required if major advances are to be made in these areas."

It might be predicted that increased use and the cost-effectiveness of microelectronically modified media may accelerate the trend for use of educational technology in industry, as well as other settings like homes, libraries, activity centers, etc.

Conclusions

What can be concluded about the future of educational technology in the next few years? This brief peek into the crystal ball has shown growth in the field, despite inflation, recession and the energy crunch. Systematically designed instruction has demonstrated its efficiency. Increasingly widespread modifications of media hardware may also influence an improvement in cost-effectiveness of other future developments in the field of educational technology. Related job roles may also be influenced by these advancements.

Evidence of this present trend for increasing educational technology was presented by Gustafsen (1979) in light of the following facts about the International Association for Educational Communications and Technology:

The division for Instructional Development is growing rapidly and is one of the largest divisions of IAECT. Agencies with the words instructional development in the form of books, mongraphs, and articles are flooding the professional literature. Training programs for instructional developers are being created in many institutions and the number of graduates of these programs is far greater than what was predicted a few short years ago. Demands for trained professionals to design, produce and manage learning systems and products might be expected to grow in relation to various applications of microelectronics to instructional media. Just how rapid this rate of growth may be remains to be seen outside the crystal ball.

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